

July 11, 1939.

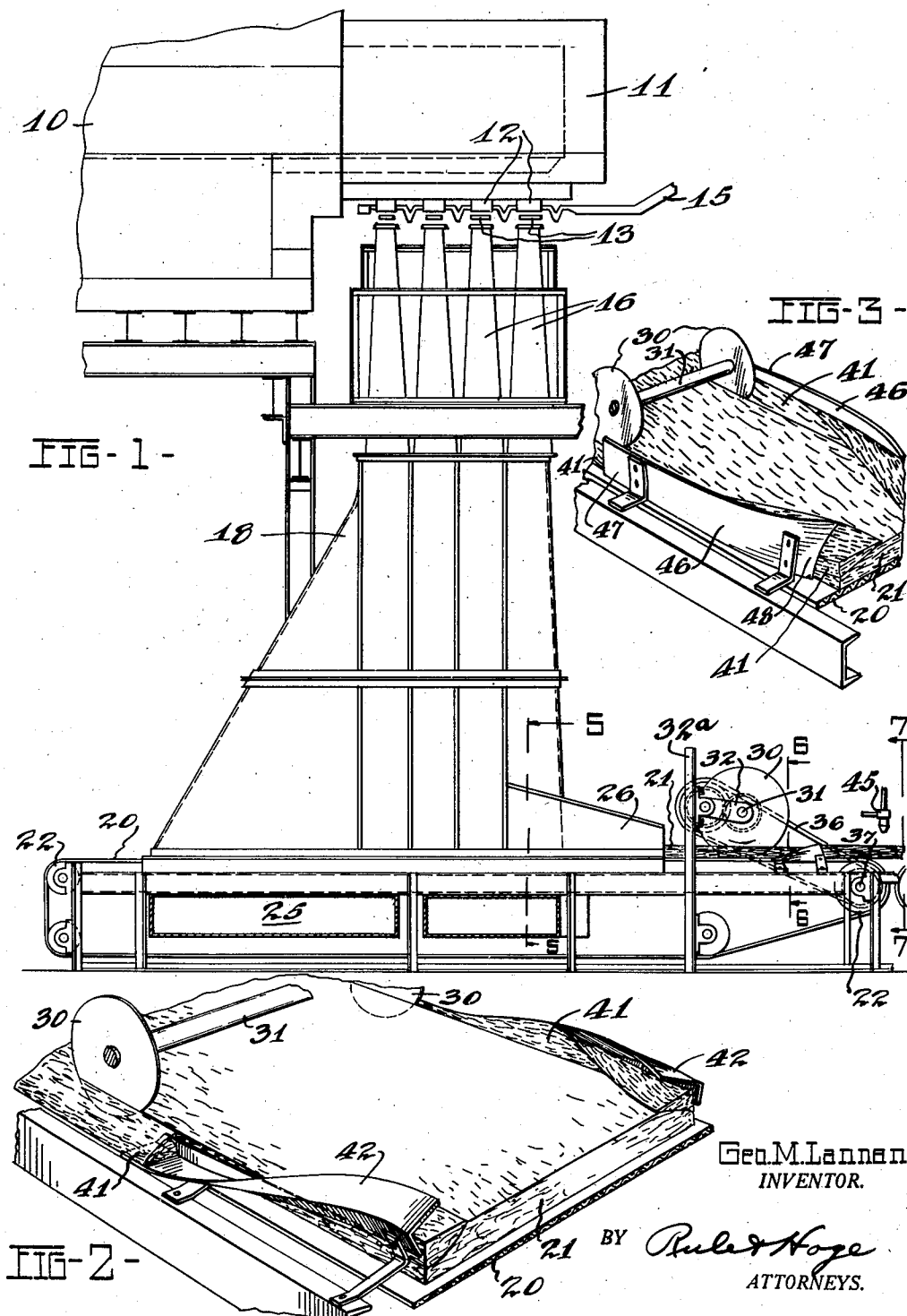
G. M. LANNAN

2,165,280

METHOD AND APPARATUS FOR FORMING A FIBROUS MAT

Filed June 3, 1936

2 Sheets-Sheet 1



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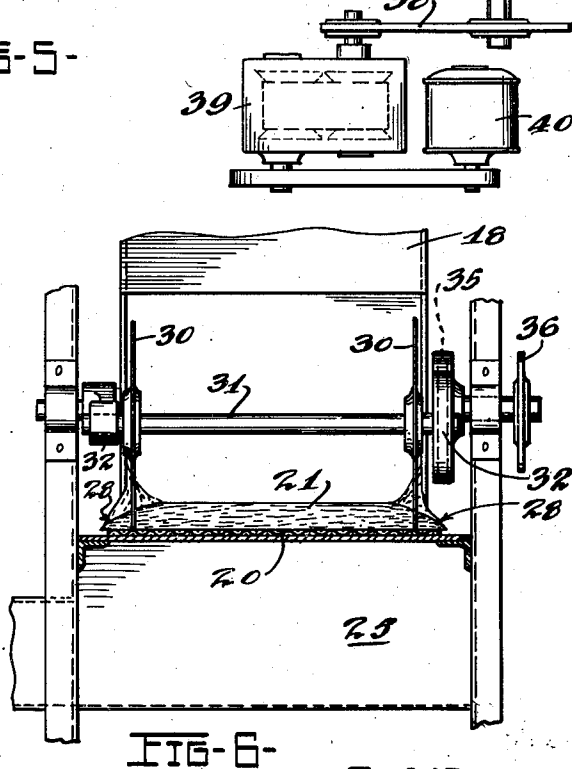
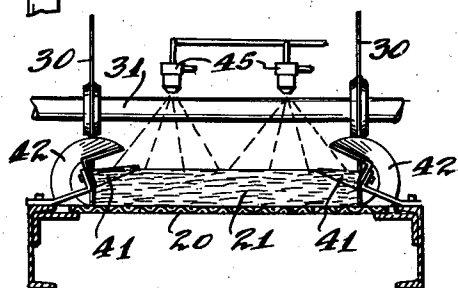
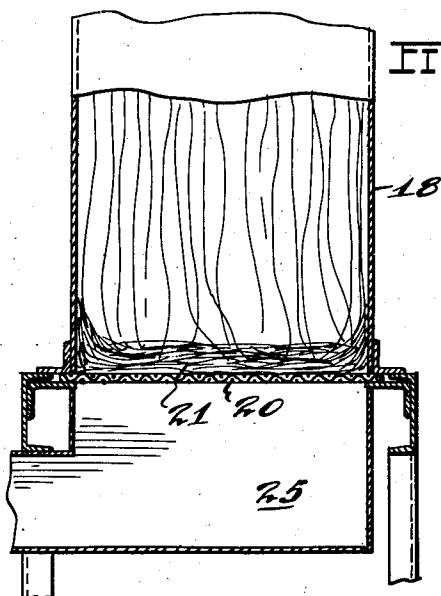
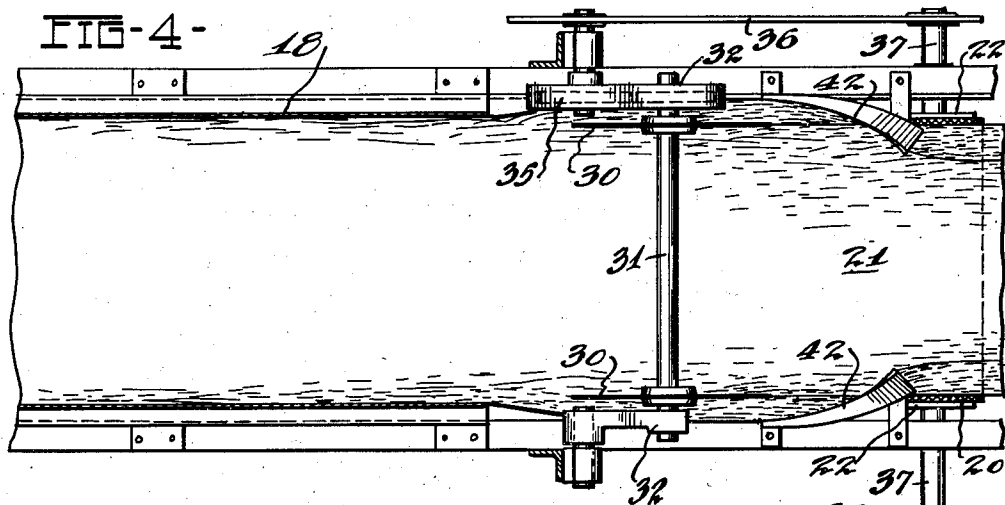
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METHOD AND APPARATUS FOR FORMING A FIBROUS MAT

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR FORMING
A FIBROUS MATGeorge M. Lannan, Newark, Ohio, assignor, by
mesne assignments, to Owens-Corning Fiber-
glas Corporation, a corporation of Delaware

Application June 3, 1936, Serial No. 83,350

10 Claims. (Cl. 19-156)

The present invention relates to a method and apparatus for forming a mat of fibrous material.

In the formation of a felted mass of fibrous material, such as a mat of glass wool formed by the projection of long attenuated fibers onto a reticulated belt or the like, it has been found difficult, if not impossible, to build up a mass having a constant depth throughout its lateral dimension. As the fibers are projected and conveyed by a gaseous vehicle, they impinge upon a collecting platform such as a screen where they intermingle and become interlocked to produce a blanket-like body. In the continuous formation of such a mat, a reticulated conveyor belt is used as the collecting screen upon which the fibers are gathered and through which the gaseous vehicle is sometimes expelled. It has been found, however, that when fibers of substantially a continuous length are projected upon a collecting belt having a restricted area for the formation of a felted mass or mat, the descending fibers tend to weave back and forth and lay themselves horizontally on the belt in haphazard arrangement. In so doing they tend to build up along the retaining or side walls to a certain degree. The depth of mat is generally greatest along the center line of the belt and tapers off to the extremities adjacent to the side walls. An uneven deposit of fibers is generally more apparent when coarser, heavier strands of continuous length are being deposited. The gaseous vehicle in this instance is less effective as a carrier and the fibers settle without great guiding influence of the gaseous blast. The result is an uneven distribution of fibers on the reticulated belt. It has been necessary heretofore when utilizing a mat of the above characteristics to cut off and discard the outer edges or margins of the mat and utilize only the built-up center portion.

In the formation of air filter units and the like, it is necessary and advantageous to provide a mat having constant depth and cross section throughout. A mat of fibrous material having thin and thick spots presents a non-uniform and inefficient filter surface for the filtration of air. The thin spots allow the free passage of air without properly arresting the dust particles, whereas, the thick or heavy spots unduly constrict and inhibit the passage of air and build up back pressure.

Filter mats made of fibrous glass have relatively thick and continuous fibers. When these fibers are precipitated upon a moving belt, they lay thereon and assume approximate parallelism with the belt in all horizontal directions. The build-

ing up process of the mat is measured by the duration of its exposure to the projection of the fibers. When relatively heavy or coarse fibers are used, as, for example, fibers having diameters greater than about .005" to .010" in diameter, the above method of projection produces a relatively stiff cake or mass rather than a flimsy, limp bat of glass wool.

In depositing such fibers having relatively large diameters, the fibers lie upon one another substantially horizontally in criss-cross relationship through the major portion of the bat. However, along the side edges which are defined by the retaining walls on either side of the belt, the fibers are deposited upon one another in more or less parallel arrangement. That is, those portions of the fibers which come to rest at these edges are largely deposited in a longitudinal direction without criss-crossing or decussating. The thickness of glass fibers prevents their being turned through a small angle and thus as the fibers are laid along the edges, the retaining walls tend to redirect the fibers inward gradually. As a result the retaining walls lie at a tangent to most of those curved portions of the fibers which extend out to the edge.

When all the portions of the fibers lying at or adjacent to the edges of the mat assume more or less parallelism, the fibers do not tend to form an open criss-cross mat formation. In its stead the fibers are more closely and densely packed together without the beneficial voids and interstices found in the central portions of the mat. Prior methods of mat formation, particularly when forming felted mats of glass wool have the foregoing as well as other disadvantages which the present invention aims to overcome.

It is an object of the present invention to provide a method and apparatus for forming a mat of fibrous material having a constant thickness or depth throughout.

Another object of the present invention is to provide a method and apparatus for continuously forming a mat of fibrous material having a uniform depth and having in particular an accurate rectangular cross section in the lateral direction.

A further object of the invention is to conserve and utilize substantially the entire production of fibrous material in the formation of a mat thereof with as little wastage or trim as possible.

A still further object of the present invention is to provide a method and apparatus for forming a mass of fibrous glass having comparative stiffness and mass integrity, particularly adaptable to air filter units.

Other objects and advantages of the present invention will become apparent from the following description taken in conjunction with the drawings, in which:

Fig. 1 is an elevational side view of an apparatus for forming glass fibers, illustrating my apparatus for forming an improved fibrous mat;

Fig. 2 is a fragmentary perspective view of an embodiment of the present invention;

Fig. 3 is a fragmentary perspective view of a modification of the apparatus shown in Fig. 2;

Fig. 4 is a plan view of the apparatus shown in Fig. 2;

Fig. 5 is a fragmentary sectional view taken along the line 5—5 of Fig. 1;

Fig. 6 is an elevational section view taken along the line 6—6 of Fig. 1; and

Fig. 7 is an elevational section view taken along the line 7—7 of Fig. 1.

Referring more particularly to Fig. 1, a glass melting and refining tank 10 is provided with a forehearth 11 within which a head of glass is maintained. The glass flows continually through feeders 12 in the floor of the boot or forehearth in a multiplicity of small streams which are acted upon by blowers 13. The issuing streams of glass are enveloped in the downward blast of steam or other gas supplied by the blowers and are thereby continuously drawn out into fibers or filaments. Electric current is supplied from any suitable source through connections 15 to electrically heat the individual feeders 12.

Spaced below the individual feeders 12 are vertically disposed spouts 16 into which the attenuated fibers are projected. The lower ends of the spouts 16 open into an expansion hood or chamber 18 which is of streamlined construction and forms an accumulating chamber within which the fibers from the several spouts are transmitted to and laid upon a reticulated conveyor belt 20 to form a mat 21. The vehicular blast of gas is permitted to expand a predetermined degree within the hood 18 to gradually reduce the velocity and the turbulence of the blast.

The conveyor belt 20 is supported on rollers 22 and continually advances at a predetermined rate carrying the mat 21 forward as it is formed. Arranged between the upper and lower leads of the belt 20 and in register with the hood 18 is an exhaust chamber 25 through which a part or all of the vehicular blast may be expelled. When relatively heavy or coarse fibers are being manufactured and projected against the belt 20, a substantial portion of the vehicular blast may be expelled over the mat and out of the front end 26 of the hood. If it is desired, suction may be applied to the exhaust chamber 25.

As may be noted particularly in Fig. 5, the fibers descend upon and are collected on the belt 20 in such a manner that the individual fibers assume a substantially parallel relation with the belt. The fibers, however, which lie one upon another extend in all horizontal directions to form a horizontal retiform web. In depositing themselves on the belt, the fibers generally retain their long length and are not broken up into a great many fibers of short length. In the production of such a web, particularly of long and relatively coarse fibers, applicant has found that the fibers tend to build up and accumulate to a certain degree along the side walls of the hood 18 and, as may be seen from Fig. 6, when the outer margins or edges 28 are carried beyond the hood 18 and are permitted to lie flat on the belt 20, the edges 28 of the resulting mat are rela-

tively thin. Moreover, when thick and consequently stiffer fibers are produced, as for filter mats or the like the outer side edges are hampered by a tendency of the fibers at these places to assume parallelism in a longitudinal direction. This phenomenon has not been illustrated for obvious reasons. The thinner tapering outer margins of the mat have heretofore been discarded, particularly when utilizing the mat for filter units or the like which required a uniform cross section.

Spaced in front of the hood 18 and along the length of the mat 21, I have provided a pair of knives or slitted disks 30, each of which overlies and contacts the belt 20 to sever a predetermined width of the outer edge of the mat. The slitter disks 30 are mounted on a shaft 31 journaled in rock arms 32 pivotally connected to standards 32^a. The weight of the slitter disks and shaft 31 may be sufficient to sever the mat 21 without the aid of power driving means. In this embodiment, the belt 20 provides sufficient frictional resistance to permit the slitter disk 30 to roll thereover and cut the advancing mat 21. If desired, however, power driven means may be provided as shown in Figs. 1, 4 and 6. Driving connection is made through gears in the gear box 35, belt 36, shaft 37, belt 38, and speed changing mechanism 39 to a motor 40. Of course, other suitable means may be provided, as one skilled in the art would readily understand.

It is the purpose of the invention to sever the outer edges 41 of the mat and turn them back upon the main body of the mat to the end that a mat having a substantially uniform cross section is fabricated. For this purpose, guide vanes 42 having a curved or twisted contour are mounted on each side of the mat in advance of the slitter disks 30. The severed portions 41 ride along the guide vanes 42 which have a spirally twisted or curved shape such that said severed portions 41 are thereby turned through an angle of about 180° and placed upon the outer extremities of the remaining portion of the mat 21. These outer extremities, however, as has been brought out hereinabove, have less depth and are thinner than the center of the mat. By turning the edges or marginal strips 41 through an angle of 180°, the thinner edge of each strip 41 is laid against a relatively thick portion of the mat 21, whereas, the thicker edge portion of the strip 41 is laid over and upon the thinnest remaining portion of the mat 21. The resultant mat is thereby given a substantially uniform and rectangular lateral cross section and practically none of the fibrous glass is wasted. The severed edge 41 when superposed on the mat to form a part thereof inter-mats and forms an integral section thereof. Moreover, I have found that the heretofore parallel arrangement of the outer fibers is substantially dissipated and the fibers assume a criss-cross decussation throughout.

Mounted above the mat 21 and adapted to spray a binder and/or coating material thereto are spray guns 45. Suitable sprays of oil, emulsions, waxes, rubber, salts such as tricresyl phosphate, soaps, resins and the like may be applied to the mat, according to the particular use to which the mat is to be put. It will be noted that a spray of such suitable material may be provided to form a binder for the mat, although the edges 41 may adhere to and be interlocked with the main body of the mat 21 without the aid of binders or coating materials.

The modification shown in Fig. 3 discloses the

slitter disks 30 associated with the belt 20, which serve to sever the outer edges 41 in a manner similar to that shown in Fig. 2. Guide vanes or baffles 46 having slightly different contours and characteristics have been provided, however, to turn over the edges 41 and lay them upon the mat 21. The rear portions 47 of the vanes 46 are vertical in order to confine the individual fibers which tend to ride up along the side walls of the hood. The vanes 46 may be formed integral with the retaining side walls of the hood 18 or attached thereto in any suitable manner. The vanes 46 are bent so as to gradually curve inwardly over the mat 21 and finally overlie the same horizontally. The front portions 48 overlie the mat 21 and serve to lay the severed edges 41 over the mat in a manner similar to that described for the embodiment shown in Fig. 2.

Variations and modifications may be resorted to within the scope of the invention as defined in the appended claims.

I claim:

1. In the method of forming a mat of long, attenuated fibrous material which comprises depositing said fibrous material on an arresting surface by means of a gaseous vehicle, wherein a mat is produced which is thicker along the longitudinal center line than at the lateral margins, the steps of severing the lateral margins of said deposited material along longitudinal lines thereof, and turning the said lateral margins of said deposited material inwardly to overlie the remaining portion of said material immediately adjacent said margins respectively and form a unitary structure therewith.

2. The method of continuously forming a mat of glass fibers all lying substantially parallel to a given plane and lying upon one another in crisscross formation, which comprises continuously depositing on a moving surface a plurality of long glass fibers having an average diameter greater than about .005 inch, weakening said precipitated mat along two lines lying parallel to the direction of movement of said surface and each line lying inwardly from a longitudinal edge thereof, and folding over the outer margins of said mat lying beyond said weakened lines and causing them to overlie the remaining portion of said mat and thereby permitting the individual fibers in said folded margins to intermat and interlock with said remaining portion to form a unitary mat.

3. The method of continuously forming a mat of glass fibers all lying substantially parallel to a given plane and lying upon one another in crisscross formation, which comprises continuously depositing on a moving surface a plurality of long glass fibers having an average diameter greater than about .005 inch, weakening said precipitated mat along two lines lying parallel to the direction of movement of said surface and each line lying inwardly from a longitudinal edge thereof, folding over the outer margins of said mat lying beyond said weakened lines and causing them to overlie the remaining portion of said mat and thereby permitting the individual fibers in said folded margins to intermat and interlock with said remaining portion to form a unitary mat, and then applying a binder to said mat to bond said margins to said remaining portion.

4. The method of forming an air filter mat of long glass fibers having an average diameter greater than about .005 inch, which comprises depositing a plurality of said fibers upon a moving surface having a continually exposed area

of predetermined size and causing said fibers to interlock and lie upon one another in mat formation on said area, continuously and simultaneously cutting along longitudinal lines a portion of each of the outer margins thereof which have a reduced depth of matted glass fibers, and turning said cut margins inwardly about said longitudinal lines through about 180° to overlie the body of said mat at its outer edges respectively and form a unitary mat therewith having a substantially constant depth throughout its lateral cross section.

5. The method of forming an air filter mat of long glass fibers having an average diameter greater than about .005 inch, which comprises depositing a plurality of said fibers upon a moving surface having a continually exposed area of predetermined size and causing said fibers to interlock and lie upon one another in mat formation on said area, continuously and simultaneously cutting along longitudinal lines a portion of each of the outer margins thereof which have a reduced depth of matted glass fibers, turning said cut margins inwardly about said longitudinal lines through about 180° to overlie the body of said mat at its outer edges respectively and form a unitary mat therewith having a substantially constant depth throughout its lateral cross section, and spraying a coating material over the surfaces of said fibers for bonding said margins to said body.

6. Apparatus for forming an air filter mat, which comprises, means for projecting by means of a gaseous vehicle a plurality of long, attenuated glass fibers, a conveyor for arresting and continuously advancing a newly formed mat of said fibrous material, means associated with said conveyor for severing the marginal portions of said mat, and guide vanes at each edge of said conveyor for turning inwardly the outer severed margins of said mat and causing them to overlie the inner remaining body portion of said mat adjacent said edges respectively.

7. Apparatus for forming an air filter mat, which comprises, means for projecting by means of a gaseous vehicle a plurality of long, attenuated glass fibers, a conveyor for arresting and continuously advancing a newly formed mat of said fibrous material, means associated with said conveyor for severing the marginal portions of said mat, guide vanes at each edge of said conveyor for turning inwardly the outer severed margins of said mat and causing them to overlie the inner remaining body portion of said mat adjacent said edges respectively, and means for applying a binding substance to the surfaces of said individual fibers to form a stiff unitary mat.

8. Apparatus for forming an air filter mat, which comprises, means for projecting by means of a gaseous vehicle a plurality of long, attenuated glass fibers, a conveyor for arresting and continuously advancing a newly formed mat of said fibrous material, means associated with said conveyor for severing the marginal portions of said mat, and guide vanes at each edge of said conveyor for turning inwardly the outer severed margins of said mat and causing them to overlie the inner remaining body portion of said mat adjacent said edges respectively, said guide vanes each having a tortuous contour whereby the said overturned margins ride along and are turned through approximately 180° by said vanes.

9. In the method of forming a mat of long, attenuated fibrous material, which comprises depositing said fibrous material on an arresting

surface by means of a gaseous vehicle, wherein a mat is produced which is thicker along the longitudinal center line than at the lateral margins, the steps of weakening said mat along two lines parallel with said center line on each side thereof in regions lying inwardly from the lateral edges of said mat to define lateral margins of said deposited material, and folding inwardly the said lateral margins along said longitudinal lines to overlie the remaining portion of said material immediately adjoining said margins respectively to form a substantially unitary mat therewith.

10. In the method of continuously forming a mat of long attenuated, fibrous material, which comprises precipitating said fibrous material on an arresting surface having a predetermined

area by means of a gaseous vehicle wherein a mat is produced which is thicker along the longitudinal center line than at the lateral margins, the steps of simultaneously and continuously advancing said surface and the said mat, weakening said mat along two lines lying parallel to the direction of movement of said surface and lying inwardly from the longitudinal edges thereof, and folding over the outer margins of said mat lying beyond said weakened lines and causing them to overlie the remaining portion of said mat and thereby permitting the individual fibers in said folded margins to intermat and interlock with said remaining portion to form a substantially unitary mat.

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